

THE GLOBAL DISTRIBUTION OF SULFATE AEROSOLS
CALCULATED WITH THE GRANTOUR/ECHAM COUPLED
MODEL. C. R. Molenkamp, J. E. Penner, J. J. Walton, and C. J.
O'Connor, Global Climate Research Division, Lawrence
Livermore National Laboratory, P.O. Box 808, Livermore, CA
94550

Knowledge of the spatial distribution of natural and anthropogenic sulfate aerosols is important because sulfate particles affect global climate directly by scattering solar radiation and indirectly by altering cloud droplet size distributions. We previously examined the climate effects of sulfate aerosols and greenhouse gas forcings using the our tropospheric chemistry model (GRANTOUR) in conjunction with CCM1, and concluded that representation of the regional distribution of atmospheric aerosols was essential for reliable prediction of climate change (Taylor and Penner, 1994).

We have recently coupled GRANTOUR with the ECHAM3 global climate model which provides several enhanced capabilities in the representation of aerosol interactions. ECHAM includes a specific representation of liquid water which allows us to represent wet phase gas-to-particle conversion of SO₂ to sulfate as well as improved parameterization of precipitation scavenging. For mixing and scavenging by convective clouds we use the vertical mass fluxes and precipitation production rates from ECHAM.

With the coupled model we calculate the global sulfur distribution over an annual cycle. Anthropogenic sources are SO₂ from fossil fuel combustion, industrial sources, and biomass burning; natural sources include biogenic oceanic sulfate (DMS), terrestrial soils, and vegetation. Gas phase interactions among these constituents and other trace species and wet-phase production inside clouds leads to formation of sulfate particles. Precipitation scavenging and dry deposition remove particles.

Spatial distributions from the present simulations are compared to observations and to our earlier simulations. We also calculate the climate forcing due to anthropogenic sulfate.

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Taylor, K. E. and Penner, J. E., 1994: Response of the climate system to atmospheric aerosols and greenhouse gases, *Nature*, **369**, 734-737.